ARTICLE 2. DEFINITIONS AND GENERAL REQUIREMENTS

Section 64415. Laboratory and Personnel.

(a) Required analyses shall be performed by laboratories approved to perform those analyses by the Department, pursuant to Section 116390, Health and Safety Code. Analyses shall be made in accordance with:

(1) EPA approved methods as prescribed at 40 Code of Federal Regulations Sections 141.21 through 141.40, 141.41, 141.42, 141.66, and 141.89; or

(2) For those analytes regulated by the Department for which no EPA approved method exists, methods approved by the Department.

(b) Sample collection, and field tests including color, odor, turbidity, pH, temperature, and disinfectant residual shall be performed by a water treatment operator certified by the Department pursuant to Section 106875 of the Health and Safety Code or by personnel trained to collect samples and/or perform these tests by the Department, a certified laboratory, or a certified operator.

NOTE: Authority cited: Sections 100275, 106875, 116375 and 116390, Health and Safety Code. Reference: Sections 116300 through 116750, Health and Safety Code; and 40 Code of Federal Regulations 141.

ARTICLE 5. RADIOACTIVITY

~~**Section 64441. Natural radioactivity**~~

~~(a) All community water systems shall monitor their water supplies for radium-226, radium-228 and uranium at least once every four years. Compliance with maximum radioactivity levels shall be based on the average of the analysis of four consecutive quarterly samples.~~

~~(b) Gross alpha particle measurement may be substituted for measurement of radium-226 and radium-228.~~

~~(1) The supply is considered to be in compliance with maximum radioactivity levels if the gross alpha particle activity does not exceed 5 picocuries per liter (pCi/l).~~

~~(2) If gross alpha activity exceeds 5 pCi/l, measurement of radium-226 shall be made.~~

~~(3) If radium-226 exceeds 3 pCi/l, measurement of radium-228 shall be made.~~

~~(4) The sum of the radium-226 and radium-228 shall not exceed 5 pCi/l.~~

~~(c) If the average maximum contaminant level for gross alpha particle activity, total radium or uranium exceeds the levels shown on Table 4, the water supplier shall report this information to the Department within 48 hours.~~

NOTE: Authority cited: Sections 208 and 4026, Health and Safety Code. Reference: Section 4024, Health and Safety Code.

~~Section 64443. Man-made radioactivity~~

~~Water systems with greater than 30,000 service connections and using surface water sources shall monitor their water supplies for tritium, strontium-90 and gross beta particle activity at least once every four years.~~

~~(a) The average concentration of beta particle activity and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than four millirem/year.~~

~~(b) Compliance with this requirement is assumed if the average concentration of gross beta particle activity is less than 50 pCi/l and if the average concentration of tritium and strontium-90 are less than those listed on Table 4.~~

~~(c) If the gross beta particle activity exceeds 50 pCi/l, an analysis of the sample shall be performed to identify the major radioactive constituent present and the appropriate organ and total body doses shall be calculated.~~

~~(d) The water supplier shall report information on sample results that exceed the maximum contaminant levels to the Department within 48 hours.~~

~~Table 4~~

~~MCL Radioactivity~~

~~*Constituent*~~	~~*Maximum Contaminant Level, pCi/l*~~
~~Combined Radium-226 and Radium-228~~	~~5~~
~~Gross Alpha particle activity (including Radium-226 but excluding Radon and Uranium)~~	~~15~~
~~Tritium~~	~~20,000~~
~~Strontium-90~~	~~8~~
~~Gross Beta particle activity~~	~~50~~
~~Uranium~~	~~20~~

NOTE: Authority cited: Sections 208 and 4026, Health and Safety Code. Reference: Sections 4017 and 4024, Health and Safety Code.

Section 64441. General Monitoring Requirements and Compliance Determinations.

(a) Each community and nontransient-noncommunity water system shall monitor for radionuclides, as applicable, except that nontransient-noncommunity water systems shall not be required to monitor radium-228 separately:

(1) During each compliance period, during the year designated on the basis of monitoring frequency and laboratory capacity by the Department; when monitoring quarterly, the system shall select either the first, second, or third month of a quarter and sample in that same month of each of four consecutive quarters.

(2) At each source, or a system may collect a minimum of one sample at every entry point to the distribution system that is representative of all sources being used under normal operating conditions; and

(3) At the same sampling site(s), unless a change is approved by the Department.

(b) Each system shall determine compliance as follows:

(1) At each sampling site, based on the analytical results for that site. Any confirmation sample result shall be averaged with the initial result.

(2) Using all monitoring results collected under this article during the previous 12 months, even if more than the minimum required number of samples was collected.

(3) By a running annual average of four consecutive quarters of sampling results where quarterly monitoring is required, or by an annual sample when applicable for tritium and strontium-90. Averages shall be rounded to the same number of significant figures as the MCL for which compliance is being determined.

(A) If any sample result will cause the annual average at any sample site to exceed the MCL, the system shall be out of compliance immediately;

(B) If a system has not analyzed the required number of samples, compliance shall be determined by the average of the samples collected at the site during the most recent 12 months; and

(C) If a sample result is less than the DLR in tables 64442 or 64443, zero shall be used to calculate the annual average, unless a gross alpha particle activity is being used in lieu of radium-226 and/or uranium. In that case, if the gross alpha particle activity result is less than the DLR, ½ the DLR shall be used to calculate the annual average.

(4) If compositing is allowed at a sampling site, by the results of a composite of four consecutive quarterly samples.

(5) If the system can provide documentation that a sample was subject to sampling or analytical errors, the Department may invalidate the result based on its review of the documentation, the sampling result, and the historical sampling data.

(6) Each system shall ensure that the laboratory analyzing its samples collected for compliance with this article calculates and reports the sample-specific Minimum Detectable Concentration at the 95% confidence level (MDC_{95}) along with the sample results. The MDC_{95} shall not exceed the DLR and is calculated as described in ANSI N42.23 Measurement and Associated Instrumentation Quality Assurance for Radiobioassay Laboratories, Appendix A.7.6.

NOTE: Authority cited: Sections 116325, 116350, and 116375, Health and Safety Code. Reference: Sections 116275, 116365, and 116385, Health and Safety Code.

Section 64442. MCLs and Monitoring - Gross Alpha Particle Activity, Radium-226, Radium-228, and Uranium.

(a) Each system shall comply with the primary MCLs in table 64442 in the drinking water supplied to the public and use the DLRs for reporting monitoring results beginning January 1, 2004:

Table 64442
Maximum Contaminant Levels (MCLs) and Detection Levels for Purposes of Reporting (DLRs)

Radionuclide	*MCL*	*DLR*
Radium-226	5 pCi/L (combined radium-226 & -228)	1 pCi/L
Radium–228		1 pCi/L
Gross Alpha particle activity (excluding radon and uranium)	15 pCi/L	3 pCi/L
Uranium	20 pCi/L	1 pCi/L

(b) By December 31, 2007, each system shall complete initial monitoring consisting of four consecutive quarterly samples at each sampling site for each radionuclide in table 64442:

(1) Data collected for a sampling site between January 1, 2001 and December 31, 2004, may be used to satisfy the initial monitoring requirement, subject to the Department's approval based on the analytical methods, DLRs, sampling sites, and the frequency of monitoring used.

(2) For gross alpha particle activity, uranium, radium-226 and radium-228, the Department may waive the final two quarters of initial monitoring at a sampling site if the results from the previous two quarters are below the DLR(s).

(c) After December 31, 2007, any new system or new source for an existing system shall begin initial monitoring within the first quarter after initiating water service to the public.

(d) After initial monitoring, each system shall monitor for each radionuclide at each sampling site at a frequency determined by the average of the initial sampling results for that radionuclide. The results of radium-226 and radium-228 shall be added, the average calculated, and a DLR of 2 pCi/L used to determine if the average is below the DLR; nontransient-noncommunity water systems shall use their total radium results with the DLR of 2 pCi/L:

(1) If the average is below the DLR, the system shall collect and analyze at least one sample every nine years.

(2) If the average is at or above the DLR, but at or below ½ the MCL, the system shall collect and analyze at least one sample every six years.

(3) If the average is above ½ the MCL, but does not exceed the MCL, the system shall collect and analyze at least one sample every three years.

(e) Each system shall use the sample results from each reduced monitoring period to determine the monitoring frequency for each radionuclide for the subsequent monitoring period, pursuant to subsection (d).

(f) If any sample result is greater than an MCL:

(1) For a system monitoring less than quarterly, quarterly samples shall be collected and analyzed to determine compliance, pursuant to section 64441(b).

(2) For a system that already has four consecutive quarterly results, compliance shall be determined pursuant to section 64441(b).

(3) The system shall monitor quarterly until the results of four consecutive quarterly sample results do not exceed the MCL.

(g) A system that monitors quarterly may composite up to four consecutive samples from a single sampling site if analysis is done within a year of the first sample's collection. If the result of the composited sample is greater than ½ the MCL, the Department may require additional quarterly samples to evaluate the range of results over time before allowing the system to reduce the monitoring frequency.

(h) A gross alpha particle activity measurement may be substituted for other measurements, as follows:

(1) For radium-226, if the gross alpha particle activity does not exceed 5 pCi/L;

(2) For uranium, if the gross alpha particle activity does not exceed 15 pCi/L.

(3) The gross alpha measurement shall have a confidence interval of 95% (1.65s, where s is the standard deviation of the net counting rate of the sample) for radium-226 and uranium.

(4) If a system uses a gross alpha particle activity measurement pursuant to this subsection, the gross alpha particle activity measurement shall be used to determine future monitoring frequency for radium-226 and/or uranium.

NOTE: Authority cited: Sections 116325, 116350, and 116375, Health and Safety Code. Reference: Sections 116275, 116365, and 116385, Health and Safety Code.

Section 64443. MCLs and Monitoring - Beta Particle and Photon Radioactivity.

(a) Each system shall comply with the primary MCLs in table 64443 in the drinking water supplied to the public and use the DLRs for reporting monitoring results beginning January 1, 2004:

Table 64443
Maximum Contaminant Levels (MCLs) and Detection Levels for Purposes of Reporting (DLRs)

Radionuclide	*MCL*	*DLR*
Beta/photon emitters	4 millirem/year annual dose equivalent to the total body or any internal organ	Gross Beta particle activity: 4 pCi/L
Strontium-90	8 pCi/L	2 pCi/L

	(= 4 millirem/yr dose to bone marrow)	
Tritium	20,000 pCi/L (= 4 millirem/yr dose to total body)	1,000 pCi/L

(b) Each system designated by the Department as vulnerable to contamination due to its proximity to nuclear facilities and/or a determination of vulnerability by a Source Water Assessment, as defined in section 63000.84, shall:

(1) Monitor quarterly for beta emitters and annually for tritium and strontium-90 at each sampling site, beginning within one quarter of being notified by the Department.

(2) The system shall continue to monitor unless notified by the Department that a review indicates the system is no longer vulnerable.

(3) If the gross beta particle activity minus the naturally-occurring potassium-40 beta particle activity at a sampling site has a running annual average less than or equal to 50 pCi/L (screening level), monitoring may be reduced to one year of quarterly samples for beta emitters and a single sample for tritium and strontium-90 once every three years (during a compliance monitoring period).

(c) Each system designated by the Department as utilizing waters contaminated by effluents from nuclear facilities on the basis of the data and/or a Source Water Assessment, shall:

(1) Monitor pursuant to paragraphs (A) through (C) at each sampling site, beginning within one quarter after being notified by the Department:

(A) For beta emitters, quarterly by analyzing three monthly samples and averaging the results or by analyzing a composite of three monthly samples;

(B) For iodine-131, quarterly by analyzing a composite of five consecutive daily samples, unless the Department has directed the system to do more frequent monitoring based on a detection of iodine-131 in the sampled water; and

(C) For strontium-90 and tritium, annually by analyzing four quarterly samples and averaging the results or by analyzing a composite of four quarterly samples.

(2) A system already designated pursuant to subsection (c) shall continue to monitor unless notified by the Department that a review has resulted in a removal of the designation.

(3) If the gross beta particle activity minus the naturally-occurring potassium-40 beta particle activity at a sampling site has a running annual average (computed quarterly) less than or equal to 15 pCi/L (screening level), monitoring may be reduced to one year in every three years and conducted pursuant to paragraph (c)(1).

(d) If a sample result is greater than an MCL:

(1) Compliance shall be determined pursuant to section 64441(b).

(2) For a sample that has a gross beta and photon radioactivity level greater than the MCL:

(A) A system shall monitor monthly beginning the month after the exceedance occurs and continue monthly monitoring until a rolling average of three consecutive monthly sample results does not exceed the MCL ;

(B) The system shall then monitor quarterly until the average of four consecutive quarterly sample results does not exceed the MCL; and

(C) Subsequently, the system shall monitor pursuant to subsection (b)(1) or (c)(1), as applicable.

(e) A system may analyze for naturally-occurring potassium-40 beta particle activity from the same or equivalent samples used for the gross beta particle activity analysis. The potassium-40 beta particle activity shall be calculated by multiplying elemental potassium concentrations (in mg/L) by a factor of 0.82 pCi/mg.

(f) If the gross beta particle activity minus the naturally-occurring potassium-40 beta particle activity exceeds the screening level:

(1) The sample shall be analyzed to identify the major radioactive constituents present and the appropriate doses shall be calculated and summed to determine compliance with the MCL for beta particle and photon radioactivity; and

(2) Except for strontium-90 and tritium for which the MCLs provide the average annual concentrations assumed to produce a total body or organ dose equivalent to 4 millirem/year, the concentration of manmade radionuclides shall be calculated on the basis of 2 liters per day drinking water intake using the 168 hour data list in "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," NBS (National Bureau of Standards) Handbook 69 as amended August 1963, U.S. Department of Commerce.

(g) A system in the vicinity of a nuclear facility may use environmental surveillance data collected by the facility in lieu of monitoring, subject to the Department's determination that the data is applicable to the system based on a review of the data and the hydrogeology of the area. In the event that there is a release from the nuclear facility, a system using surveillance data shall begin monitoring pursuant to paragraph (b)(1) or (c)(1), whichever is most applicable.

NOTE: Authority cited: Sections 116325, 116350, and 116375, Health and Safety Code. Reference: Sections 116275, 116365, and 116385, Health and Safety Code.

Section 64447.3. Best Available Technologies (BATs) - Radionuclides

The technologies listed in tables 64447.3-A, B and C are the best available technology, treatment technologies, or other means available for achieving compliance with the MCLs for radionuclides in tables 64442 and 64443.

Table 64447.4-A
Best Available Technologies (BATs)
Radionuclides

Radionuclide	*Best Available Technology*
Combined radium-226 and radium-228	Ion exchange, reverse osmosis, lime softening

Uranium	Ion exchange, reverse osmosis, lime softening, coagulation/filtration
Gross alpha particle activity	Reverse osmosis
Beta particle and photon radioactivity	Ion exchange, reverse osmosis

Table 64447.4-B
Best Available Technologies (BATs) and Limitations for Small Water Systems
Radionuclides

UnitTtechnologies	*Limitations (see footnotes)*	*Operator Skill Level Required*	*Raw Water Quality Range and Considerations*
1. Ion exchange (IE)	(a)	Intermediate	All ground waters
2. Point of use (POU), IE	(b)	Basic	All ground waters
3. Reverse osmosis (RO)	(c)	Advanced	Surface waters usually require pre-filtration
4. Point of use RO	(b)	Basic	Surface waters usually require pre-filtration
5. Lime softening	(d)	Advanced	All waters
6. Green sand filtration	(e)	Basic	
7. Co-precipitation with barium sulfate	(f)	Intermediate to advanced	Ground waters with suitable quality
8. Electrodialysis/electrodialysis reversal	…….	Basic to intermediate	All ground waters
9. Pre-formed hydrous manganese oxide filtration	(g)	Intermediate	All ground waters
10. Activated alumina	(a), (h)	Advanced	All ground waters; competing anion concentrations may affect regeneration frequency
11. Enhanced coagulation/filtration	(i)	Advanced	Can treat a wide range of water qualities

Limitation Footnotes:

[a] The regeneration solution contains high concentrations of the contaminant ions, which could result in disposal issues.

[b] When POU devices are used for compliance, programs for long-term operation, maintenance, and monitoring shall be provided by systems to ensure proper performance.

[c] Reject water disposal may be an issue.

[d] The combination of variable source water quality and the complexity of the water chemistry involved may make this technology too complex for small systems.

[e] Removal efficiencies can vary depending on water quality.

[f] Since the process requires static mixing, detention basins, and filtration, this technology is most applicable to systems with sufficiently high sulfate levels that already have a suitable filtration treatment train in place.

[g] This technology is most applicable to small systems with filtration already in place.

[h] Chemical handling during regeneration and pH adjustment may be too difficult for small systems without an adequately trained operator.

[i] This would involve modification to a coagulation/filtration process already in place.

Table 64447.4-C
Best Available Technologies (BATs) for Small Water Systems by System Size
Radionuclides

Contaminant	*Compliance Technologies for System Size Categories (Population Served); Numbers Correspond to Table 64447.2-B*		
	25-500	*501-3,300*	*3,300 – 10,000*
Combined radium-226 and radium-288	1, 2, 3, 4, 5, 6, 7, 8, 9	1, 2, 3, 4, 5, 6, 7, 8, 9	1, 2, 3, 4, 5, 6, 7, 8., 9
Gross alpha particle activity	3, 4	3, 4	3, 4
Beta particle activity and photon radioactivity	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4
Uranium	1, 2, 4, 10, 11	1, 2, 3, 4, 5, 10, 11	1, 2, 3, 4, 5, 10, 11

NOTE: Authority cited: Section 116370, Health and Safety Code. Reference: Section 116350, Health and Safety Code.